

CHAPTER 7

WASTEWATER MANAGEMENT SYSTEMS – FIVE OPTIONS

7.1 INTRODUCTION

Five options for wastewater systems are presented in this chapter which attempt to fulfill the purpose of this report as set forth in Section 1.2: to provide versatile concept-level planning for a variety of needs regarding wastewater collection, treatment and disposal within the proposed service area. This chapter describes four options for public sewer systems that would utilize decentralized approaches as well as the traditional centralized solutions (centralized sewer collection systems and centralized wastewater treatment facilities). A fifth alternative (Option 1 in Appendix B), was developed by the public, and promotes the continuing use of private onsite wastewater systems.

The purpose of this chapter is to summarize and compare these five options and contrast them against the particular characteristics of the Clinton community which includes: topography (three distinct drainage basins) with upland and beachfront; rural character; seasonal occupancy; current use of on-site septic systems; land-use zoning regulations; and the varying needs regarding wastewater management.

In general, the options are numbered in a sequence that begins with the “least centralized” and ends with the “most centralized” system. A summary table is presented for each option that lists the key technical parameters together with a brief list of the advantages and disadvantages that can be identified at this time. It is anticipated that additional community-based issues may also emerge in the future that would need to be factored into any decision-making actions. Such issues are beyond the scope of this plan.

A brief description of each of the five options is as follows:

- **Option 1 - Onsite Wastewater Systems:** This option involves the continued use of traditional, privately owned septic systems and advanced onsite systems for single lots as well as cluster systems. The objective of this option is to actively promote good operation and maintenance practices of existing onsite systems and to develop solutions for replacing or upgrading existing systems and for designing and building new systems in the future. Such onsite systems would be permitted and regulated by Island County Health Department however DOH or DOE may regulate some larger systems. This option was developed by the public and is not intended to be offered as an equivalent to the other options. This option is however, an immediate positive step towards preventing pollution of groundwater and provides the community with a potential alternative to the other options. Refer to Appendix B for a detailed presentation of this option.

- **Option 2 - Three De-Centralized MBR Plants with Reclamation and Reuse:** Membrane Biological Reactor (MBR) process technology, also called immersed membranes, submerged membranes or micro filtration. This option would strategically locate up to three small treatment plants at separate sites within the proposed service area and effluent disposal is accomplished by reclamation and reuse methods. For the purposes of this plan, sewage solids are not conveyed to the treatment plant and individual septic tanks are used to retain solids onsite. Wastewater is conveyed to the treatment plant by low-pressure STEP system however, grinder pump systems could be used as well.
- **Option 3 - Single Centralized MBR Plant with Reclamation and Reuse:** The treatment technology is the same as Option (2) with one single plant instead of three small-sized treatment plants. Effluent disposal is characterized by reclamation and water reuse. For the purposes of this plan, sewage solids are not conveyed to the treatment plant and individual septic tanks are used to retain solids onsite. Wastewater is conveyed to the treatment plant by low-pressure STEP system however, grinder pump systems could be used as well.
- **Option 4 - Single Centralized SBR Plant with Reclamation and Reuse:** Sequencing Batch Reactor process (SBR technology) with tertiary filtration allowing reclamation and reuse of wastewater effluent. A single treatment facility would serve the entire proposed service area. All wastewater is conveyed to the treatment plant by a combination of gravity pipeline and, for certain areas, by vacuum and grinder systems. No onsite septic tanks are required
- **Option 5 - Single Centralized SBR Plant with Marine Outfall:** SBR treatment process would produce secondary effluent (not reclaimed water) and effluent disposal is by marine outfall instead of reclamation and reuse methods. A single treatment facility would serve the entire proposed service area. Sewage collection system is generally the same as Option (4).

The wastewater treatment options described below are generally matched to a particular method of sewage collection because of specific technical compatibility's or economy. The choice of the treatment system sometimes influences the method of sewage collection and vice-versa.

7.2 OPTION 1 – COLLECTIVE MANAGEMENT OF ONSITE WASTEWATER TREATMENT AND DISPOSAL SYSTEMS

Option 1 is a community-generated option, not authored by CHS Engineers; therefore, it appears in detail in Appendix B of this plan.

Collective management of decentralized onsite wastewater treatment and disposal systems would establish programs to provide approved solutions which could include traditional and advanced on-site systems as well as cluster systems serving multiple homes and businesses in areas where population is more dense or located in areas with problematic soil conditions.

This option would provide community-wide programs that could provide technical resources, education and function as a liaison to regulatory agencies as may be necessary to implement a combination of private cluster systems and private on-site systems using advanced and conventional technology. CWD endorses this option but does not intend to be the agency to administer this program.

7.3 OPTION 2 - THREE DE-CENTRALIZED MBR PLANTS WITH RECLAMATION AND REUSE

Membrane Biological Reactor process (MBR technology), also called immersed membranes, submerged membranes, or microfiltration, is an activated sludge process that utilizes a physical barrier, a plate-type membrane, to separate wastewater solids from liquid. Option 2 proposes to take advantage of the compact size and modular, pre-engineered MBR process equipment. This option identifies three separate, small, independent treatment plants, the location of which takes into account localized needs in three distinct service areas within the proposed service area. Refer to Figures 1.2 and 5.2 that show the suggested service areas and plant locations respectively. These areas within the proposed service area, are defined on the basis of the character of existing development and land use zoning and to a limited extent on the topographic drainage basins. For this option, onsite septic tanks are used in conjunction with STEP pressure collection systems such that most wastewater solids are not conveyed to the treatment plants.

Membrane Biological Reactor (MBR) process technology has only recently been marketed in this area, and provides improved new opportunities for municipal wastewater treatment. Advantages of the MBR process are summarized as follows:

- Produces extremely high quality effluent that is ideal for effluent reclamation and reuse.
- Plant is efficient, easy to operate, highly reliable and has low maintenance needs.

- Very small footprint for plant tankage and equipment such that the whole facility can usually be installed inside a building.
- Small, “package plant” systems can be engineered and installed quickly and are ideal for de-centralized treatment using multiple small plants.

A key disadvantage of MBR technology is that the current manufacturer of this technology (Kubota) is a sole source provider although other flat plate membrane manufacturers are expected to enter the market soon.

MBR process technology or membrane microfiltration technology for wastewater treatment is relatively new in the United States; however, it has been in use in Europe and Japan for many years. MBR wastewater process equipment is being implemented for use or testing in increasing frequency in this region, including the following locations:

- Tulalip Tribes, Quilceda Village & Casino, Marysville, WA, 1.2 MGD
- Bandon Dunes Resort, Southern Oregon, 0.125 MGD
- Eagle Crest Resort, Central Oregon, 0.10 MGD
- City of Duvall, WA, Pilot plant
- Jamestown – S’Klallum Tribe, Seven Cedars Casino, Olympic Peninsula WA, 0.125 MGD
- West Point Wastewater Treatment Plant, King County, WA, Pilot plant
- Stevens Pass Ski Area, WA, 0.20 MGD
- City of Concrete, WA

The most significant difference between other activated sludge processes (like SBR) and the MBR process is that the MBR process does not require a clarifier or settling tank. This eliminates the problems, risks, challenges and costs associated with operation of most conventional activated sludge treatment plants to maintain a biomass that can settle by gravity. Operation of the MBR plant is significantly simplified and controllable. In addition, the MBR process occupies a relatively small area because the mixed liquor suspended solids (MLSS) of the reactor tank are at a much higher concentration than ordinary activated sludge processes. An additional advantage of the MBR process is that it is ideally suited to for biological nutrient removal (BNR) applications as coagulated metal salts are easily captured as phosphorous in the waste sludge. Nitrogen removal is inherently provided by the MBR process which is very important for effluent reclamation and reuse purposes.

Wastewater entering the MBR process is collected in an equalization tank in order to dampen the surge flows from pump stations, etc. and is screened to remove floatable or grit materials of a size 1/8-inch or larger. A regulated amount of flow is then transferred to an anoxic tank where a recycle stream of flow from the MBR reactor tank is mixed with the influent wastewater that serves

three purposes: removes nitrates, recovers lost alkalinity and improves filterability.

The MBR reactor is essentially a high concentration MLSS activated sludge process with an integral (in-tank) solid-liquid separation mechanism – membrane unit. Membrane units are available in two configurations: flat panels or hollow fibers. Flat panel membranes as used in the MBR process have many important advantages over the hollow fiber type thus flat panel type membranes are recommended. Flat panel membranes are arranged in parallel assemblies called “cassettes”. The membranes have an average porosity of 0.4 microns and an effective porosity of 0.1 microns, which is small enough to block virtually all bacteria and viruses. The diffuser case supports the membranes and houses the aeration diffuser equipment. As air bubbles are emitted at the diffuser in the bottom and channeled between each of the membrane panels, the aeration action serve three purposes: to transfer oxygen to the wastewater organisms for biological assimilation, sweep solids away from the surface of the membranes and to create a pressure gradient between the top and bottom of the membrane cassette.

Occasionally, a membrane cleaning procedure using bleach solution should be performed to remove fouling and restore optimum trans-membrane capacity. The cleaning process is fully automatic and takes only a few hours. Replacement of membranes should be anticipated at approximately 8-year intervals however longer service life is possible under some conditions. The purchase cost of membrane units were previously rather high however such costs have steadily declined due to higher production quantities and advancements in the manufacturing process.

The trans-membrane pressure gradient created by the system, forces water from the MLSS through the membrane into a permeate stream leaving the solids behind. The permeate (filtered) water is the effluent stream from the plant and is equal to or better than effluent from conventional activated sludge plants with tertiary treatment (sand or fabric filters).

Flow through the plant is regulated by a flow control valve on the permeate lines and liquid levels in the MBR tanks. The system is fully automated using programmable logic controllers (PLCs, computers).

Another significant advantage of the MBR technology is that increases in treatment capacity can be added in small increments by simply installing additional membrane cassettes in existing tanks. Equipment such as pumps and aeration blowers can be replaced and upsized at specific intervals because they usually have a service life of 10 to 15 years.

In summary, the key advantages of MBR process are as follows:

- No clarifier/settling tank necessary
- Accommodates small incremental expansions
- Produces high quality effluent (exceeds Class A reclaimed water standards for reuse)
- Small facility footprint
- Low operator attention, automated
- Nutrient removal capability

MBR treatment plants can be implemented in either of two ways: two or more pre-engineered package (de-centralized) plants or a single custom engineered (single-central) plant. The pre-engineered package treatment plants would be smaller in size and are mostly preassembled including tankage and process piping, pumps, blowers etc. and trucked to the site to be installed on a foundation. Pre-engineered package plants are proposed for this de-centralized option two.

Advantages and reasons for using de-centralized sewage collection and treatment are summarized as follows:

- Topography: the proposed service area ranges from waterfront (elevation = sea level) to upland (elevation = 360'). In addition there are three separate drainage basins. Topographical conditions significantly influence the layout of traditional sewage collection and treatment systems. With a de-centralized system it is generally less complicated to extend collection pipes because it is not necessary to cross over the dividing crest of drainage basins.
- Patterns of land development result in distinctly different areas ranging from dense beachfront homes, active commercial and business district to sparse rural residential neighborhoods. There are distinctly different levels of need and relative urgency with respect to wastewater collection, treatment and disposal for the proposed service area. A de-centralized system makes it easier for a given area (small segment of the District) to independently build and operate sewage collection and treatment facilities if desired.
- Utilization of reclaimed wastewater effluent can be implemented easier if the (de-centralized) wastewater treatment plants are located near the reuse sites. This minimizes the amount of conveyance pipe and the costs for pumping.

Sewer Collection System for MBR Process:

If the MBR treatment plant option is selected, it is advantageous to utilize a STEP system for sewage collection because the septic tanks provide beneficial removal of grit

and debris that might otherwise damage the membrane cassettes. Septic Tank Effluent Pump (STEP) Systems are comprised of three main elements: a septic tank, a pump, and small diameter pressure sewer lines. All generated sewage enters the customer's septic tank, in the same manner as a traditional on-site septic system. Most solids settle out to the bottom of the septic tank, floatables, grease and scum accumulate in the top and the clarified liquid portion of the sewage is pumped out into the pressure sewer lines and conveyed to the wastewater treatment plant. With pressure sewer lines, topography is not a major issue, consequently they can be installed at relatively shallow depths, similar to water lines. Operating pressures for STEP systems can be over 100 psi. Typically for STEP systems, the septic tank along with the pump components are owned and maintained by the sewer district. STEP systems can produce significant odor problems at discharge locations such as the wastewater treatment plant or pump stations unless special care is taken to suppress odors in the facility design.

A pressure (STEP) system is suggested in conjunction with wastewater treatment process Options 2 and 3 where sewage solids are not conveyed to the treatment plant, which is preferable for the MBR process.

A STEP system can utilize existing septic tanks if they are in good condition, otherwise new septic tanks will be installed. All septic tanks need to be pumped out periodically. The STEP system would not convey solids to the treatment plant consequently the conveyance pipes can be small diameter.

The total length of conveyance pipe within the system is approximately 9 miles. About 7 miles (77%) are between 1.25" and 2.5" diameter, while the remaining 2 miles (23%) is between 3" and 8" diameter. Refer to Figure 5.2 which shows the collection pipe network.

A pressure sewer system has significant flexibility in the way the collection network can be configured and expanded. Planning and construction of a pressure sewer system can be done in a manner very similar to a water distribution system. Compared to gravity sewers, pressure sewer pipes can be smaller, buried relatively shallow and do not need to be located at the low elevation side of a lot.

Because there are a large number of existing septic tanks in the proposed service area, the ability exists to retain sewage solids at the customers lot, Membrane Biological Reactor (MBR) technology could be employed for the wastewater treatment plant. MBR treatment plants and low pressure (STEP) systems would reduce sewer maintenance costs as there is less potential for blockages. There would also be significantly less preliminary treatment (screening, grit removal, etc.) and sludge handling loads at treatment plants. In summary, Option 2 optimizes the use of pressure sewers (STEP) and includes septic tanks at each customer's lot to retain wastewater solids.

Advantages:

1. MBR process is proven, reliable and economical.
2. Multiple, decentralized wwtp provide flexibility to address localized community needs.
3. Reclamation and Reuse could reduce potable water use.
4. Very short time to implement.
5. Phased capacity upgrades in small increments.
6. Simple to operate.
7. Extremely high-quality, consistent effluent.
8. Nitrogen removal is inherent in the basic process.
9. MBR package plants can be enclosed inside buildings.

MBR, Three De-Centralized Plants with Reclamation and Reuse, Summary Option 2

Wastewater Collection:	STEP, low pressure
Treatment Plant Process:	Membrane Biological Reactor (MBR) - microfiltration
Effluent quality:	Tertiary <5/5 (BOD/TSS), w/ nitrogen removal
Initial Plant Capacity:	150,000 gpd total for 3 plants
Expansion or upgrade potential:	None needed within year 20 year period
Effluent Disposal Method:	Reuse methods per Table 6.1
Effluent Reuse Potential:	Any Class A use
Sludge Handling:	Thickening at wwtp, haul offsite for dewatering and disposal
Time to implement:	Less than 2 years for one or more plants
Plant Site area:	Approximately ¼ acre each (see Figures 7-1, 7-2, 7-3)
Residential customers:	353 connections
Commercial acres served:	33.8 (406 ERUs)

7.4 OPTION 3 - MBR, SINGLE CENTRALIZED PLANT WITH RECLAMATION AND REUSE

Option 3 uses Membrane Biological Reactor process technology for a single plant to serve the proposed service area. The custom-engineered plant would be used for the single, centralized treatment approach. Process equipment would be purchased and installed in site-built concrete tankage, process piping etc.

A key disadvantage of MBR technology is that the current manufacturer of this technology (Kubota) is a sole source provider although other flat plate membrane manufacturers are expected to enter the market soon.

Advantages:

1. MBR process is proven, reliable and economical.
2. MBR has lower overall operation and maintenance cost compared to SBR.
3. Reclamation and Reuse could reduce potable water use.
4. Short time to implement.
5. Phased capacity upgrades in small increments.
6. Simple to operate.
7. Extremely high-quality, consistent effluent.
8. Nitrogen removal is inherent in the basic process.
9. MBR plant site is smaller than a SBR site.

MBR, Single Centralized Plant with Reclamation and Reuse, Summary Option 3

Wastewater Collection:	STEP, low pressure
Treatment Plant Process:	Membrane Biological Reactor (MBR) - microfiltration
Effluent quality:	Tertiary <5/5 (BOD/TSS), w/ nitrogen removal
Initial Plant Capacity:	75,000 gpd
Incremental upgrade potential:	25,000 increments up to 150,000 gpd
Effluent Disposal Method:	Reuse methods per Table 6.1
Effluent Reuse Potential:	Any Class A use
Sludge Handling:	Thickening at wwtp, haul offsite for dewatering and disposal
Time to implement:	2 years following approved Engineering Report
Plant Site area:	Approximately 1/2 acre (see Figure 7-4)
Residential customers:	353 connections
Commercial acres served:	33.8 (406 ERUs)

7.5 OPTION 4 - SBR, SINGLE CENTRALIZED PLANT WITH RECLAMATION AND REUSE

Option 4 uses the Sequencing Batch Reactor process (SBR technology) with reclamation and reuse of wastewater effluent at a single treatment facility to serve the entire proposed service area. For the purposes of this plan, wastewater solids are conveyed to the treatment plant, thus no septic tanks are needed however a STEP system could be used as well.

(From the R. W. Beck Report):

The sequencing batch reactor (SBR) is a form of the activated sludge process in which aeration and solids separation takes place in the same tank, eliminating the need for separate secondary clarifiers. The process employs a five-stage cycle: fill, react, settle, decant, and idle. During the fill stage, wastewater enters the tank and mixes with the settled biological solids remaining from the previous cycle. The tank is normally mixed during the fill stage and may be aerated. During the react stage, the mixed liquid is subject to aeration, causing oxidation of organic matter. Aeration and mixing are stopped during the settle stage, allowing solids to settle. Clarified supernatant is withdrawn during the decant stage. After decanting, some solids are wasted from the bottom of the tank to sludge processing facilities during the idle stage.

Most small municipal SBR plants consist of two parallel tanks. With two reactor tanks operating in parallel, the influent is directed only to one of the tanks at any one time so that no influent enters a tank during the react, settle, decant and idle stages.

Critical components of an SBR system include the aeration system, the decant system and the control system. Jet aeration is quite common because of its ability to mix independent of aeration. Diffused air systems with separate mixers are also used.

This option maximizes gravity sewer pipeline, conveys all wastewater solids to the treatment plant and minimizes alternative conveyance methods.

Option 4 is comprised mainly of gravity lines with the exception of the following areas: Waterfront lots on Brighton Beach and Columbia Beach would be served most effectively by alternative wastewater collection systems such as vacuum sewers, STEP or grinder systems.

It is unlikely that a centralized wastewater treatment plant would be located on the waterfront; consequently at least two pump stations will be needed to lift the sewage from the waterfront areas up to a treatment plant in the upland area.

The three separate natural drainage basins may impose some topographical obstacles to linking the basins together by gravity collection pipe network thus necessitating one or two sewage pumping stations in the upland area.

Conventional gravity sewers are not recommended for the waterfront areas because of excessive trench depth and difficult excavation conditions. Vacuum or pressure sewers are more appropriate for this area.

If wastewater treatment is to be accomplished by a single, centralized plant, it generally will be necessary to construct more pipeline and larger diameter pipe to create the initial collection and conveyance network compared to de-centralized treatment approach.

A conventional gravity sewer collection system must be configured to conform with the topography, consequently there is little flexibility in the manner of expanding the collection network. Gravity pipeline generally would be larger, buried deeper and have greater total length compared to a pressure sewer system serving the same area.

Option 4 consists of predominantly gravity lines with two smaller vacuum or grinder systems to serve the waterfront areas. The gravity portion of the system consists of approximately 7 miles of pipe, of which 80% is 8" diameter, with 10", 12", and 15" diameter pipe comprising the remaining 20%. The gravity portion of the system would serve all areas within the sewer district boundary except the waterfront homes along Brighton Beach and Columbia Beach. All sewage solids are conveyed to the treatment plant and there are no onsite septic tanks needed.

Waterfront property along both Brighton and Columbia Beaches would be served by either a vacuum or a grinder pump system. Approximately 2.5 miles of pipe ranging from 2" to 8" diameter would be installed. In the case of vacuum sewers, each house would have a small sump tank buried on site, which would control the release of sewage into the system. When a certain volume of sewage is reached within the tank, a valve automatically opens for a short time and the sewage is "vacuumed" into the conveyance pipeline and carried to the central vacuum station under negative pressure. In the case of a grinder pump system, each house would have a small sump tank and a grinder pump would convey the sewage by positive pressure.

This combination of gravity and vacuum sewer system is used in conjunction with wastewater treatment Options 4 (and 5) because all sewage solids are conveyed to the treatment plant which is the SBR process.

Wastewater Treatment Plant Site

The usual location for a wastewater treatment plant is at the lowest elevation of the service area so that most sewage is conveyed by gravity and a receiving water body for effluent discharge is also close by. However, at Clinton, the lowest point is essentially somewhere along the shoreline. Disadvantages of the shoreline treatment plant sites are: parcel size is very small requiring special design and construction measures for a compact facility and close proximity to existing residences that would necessitate aesthetic measures including visual screening, noise abatement and special odor control equipment. Consequently, there are other factors that will be important in defining the most appropriate site for a wastewater treatment plant whether it be a single centralized SBR or a single centralized MBR treatment plant.

Presently, there are two potential sites identified for the centralized wastewater treatment plant. The following is a discussion of the advantages and disadvantages for each of the sites:

The site identified as “Site #2” is actually three separate, cleared, unimproved land parcels under single, private ownership located on the west side of Conrad Street, south of Berg Road. The advantages of this site are: it is centrally located within the service area and is at an elevation that is low enough (75’) to be reached by pumps at the waterfront and by gravity from most of the upland service area. The site has adequate land area (2.8 acres) for a standard plant footprint with additional area for buffer and future expansion. Shortcomings of this site are that it is a relatively long distance away from the preferred marine outfall location (necessary for Option 5) and that the property is otherwise very desirable for residential development.

The site identified as “Site #6” is a large forested parcel of approximately 40 acres, owned by the Washington Department of Natural Resources (DNR) and is located at Humphrey Road, west of both Tiffany Drive and Marshall Road.

Advantages of this site:

- Close to the recommended marine outfall site (necessary for Option 5),
- Sewage can be conveyed by gravity from much of the upland service area,
- Large forested land area could be used for land application of treated effluent rather than the marine outfall,
- Land is zoned Rural and would not otherwise be used for residential.

Shortcomings of this site:

- Purchase of the entire parcel from DNR would be required initially, however the District may subsequently sell the residual land not needed for the plant development.
- Site is at an elevation of 120 feet, which would preclude the opportunity for individual grinder pumps along the waterfront to pump directly to the plant.

Phasing:

It is generally assumed that waterfront lots and RC zoned property in the area of SR525 comprise the areas most likely to need or benefit from a community sewer system. Most upland residential areas and other RC lots not fronting SR525 are assumed to connect to the sewer at later times in the future. Therefore, the initial phase of sewer system construction is proposed to include the following facilities:

- Vacuum systems to serve both waterfront residential areas (Brighton and Columbia Beaches)

- A pump station to lift sewage from the waterfront (near the ferry terminal) to the upland gravity collection sewers.
- Gravity sewer along SR 525 frontage.
- Conveyance pipeline along Humphrey Road extending from SR 525 to the WWTP west of Tiffany Drive.

Subsequent phases of collection sewer mains that would occur within 20 years might include some of the side streets in the central area and the Tiffany and Marshall Road neighborhoods at the south end of Columbia Beach. Remaining collection system extensions that would likely be built beyond 20 years include the upland residential areas such as; Central Ave., Simmons Drive, Harding Ave., Berg Rd., Conrad St., the Clinton Park Plat etc.

Advantages:

1. SBR and sand filter are proven, reliable, economical treatment processes.
2. SBR has slightly lower power cost compared to MBR.
3. Reclamation and Reuse could reduce potable water use.

Disadvantages:

1. SBR plant facilities are significantly oversized in early years.
2. Moderate amount of time and cost to implement.
3. Process upsets, settling problems impair effluent quality.
4. Requires collective participation of many residents and businesses.
5. SBR Wastewater Treatment Plant site is more than 80% larger than a comparable MBR site.
6. Nitrogen removal is not accomplished without additional facilities.

SBR, Single Centralized Plant, Reclamation and Reuse, Summary Option 4

Wastewater Collection:	Gravity, (or pressure sewer)
Treatment Plant Process:	Sequencing Batch Reactor (SBR) w/ tertiary filtration
Effluent quality:	Secondary, 10/10 (BOD/TSS), no BNR
Initial Plant Capacity:	150,000 gpd
Incremental upgrade potential:	None within 20 year period
Effluent Disposal Method:	Reuse methods per Table 6.1
Effluent Reuse Potential:	Any Class A use
Sludge Handling:	Thickening at wwtp, haul offsite for dewatering and disposal
Time to implement:	2 to 3 years following approved Engineering Report
Plant Site area:	Approximately 1 acre (see figure 7-5)
Residential customers:	353 connections
Commercial acres served:	33.8 (406 ERUs)

7.6 OPTION 5 - SBR, SINGLE CENTRALIZED PLAN WITH MARINE OUTFALL

Option 5 involves essentially the same collection system and treatment process as Option 4 and the discussion presented above for Option 4 is mostly applicable for Option 5 as well. Key differences are the longer time period necessary for approval of the marine outfall and that the plant site location would need to be coordinated with the location of the marine outfall.

Advantages:

1. SBR is proven, reliable, economical treatment process.
2. SBR has slightly lower power cost compared to MBR.
3. Marine outfall will not “encumber” land for effluent disposal.

Disadvantages:

1. Significant time and cost to implement marine outfall.
2. Environmental permitting for marine outfall is complicated.
3. Does not reduce potable water use.
4. SBR plant facilities significantly oversized in early years.
5. Process upsets, settling problems impair effluent quality.
6. Requires collective participation of many residents and businesses.
7. SBR WWTP site is more than 50% larger than a comparable MBR site.
8. Nitrogen removal is not accomplished without additional facilities.

SBR, Single Centralized Plant with Marine Outfall, Summary Option 5

Wastewater Collection:	Gravity, (or low pressure sewer)
Treatment Plant Process:	Sequencing Batch Reactor (SBR) w/ tertiary filtration
Effluent quality:	Secondary, 10/10 (BOD/TSS), no BNR
Initial Plant Capacity:	150,000 gpd
Incremental upgrade potential:	None within 20 year period
Effluent Disposal Method:	Reuse methods per Table 6.1
Effluent Reuse Potential:	Any Class A use
Sludge Handling:	Thickening at wwtp, haul offsite for dewatering and disposal
Time to implement:	2 to 3 years following approved Engineering Report
Plant Site area:	Approximately 1 acre (see Figure 7-6)
Residential customers:	353 connections
Commercial acres served:	33.8 (406 ERUs)